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SCIENCE

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THE PHYSIOLOGICAL IMPORTANCE OF PHASE BOUNDARIES¹

EVEN a hasty consideration of the arrangements present in living cells is sufficient to bring conviction that the physical and chemical systems concerned operate under conditions very different from those of reactions taking place between substances in true solution. We become aware of the fact that there are numerous constituents of the cell which do not mix with one another. In other words, the cell system is one of many "phases," to use the expression introduced by Willard Gibbs.

Further, parts of this system which appear homogeneous under the ordinary microscope are shown by the ultra-microscope to be themselves heterogeneous. These are in what is known as the colloidal state. Some dispute has taken place as to whether this state is properly to be called a heterogeneous one, but it is sufficient for our purpose to note that investigation shows that the interfaces of contact between the components of such systems are the seat of the various forms of energy which we meet with in the case of systems obviously consisting of phases which can be separated mechanically, so that considerations applying to coarsely heterogeneous systems apply also to colloidal systems. Although the phases of a colloidal system can not be so obviously and easily separated as those of an ordinary heterogeneous one, this can be done almost completely by filtration through membranes such as the gelatin in

¹ Address of the President of the Section of Physiology at the Manchester Meeting of the British Association for the Advancement of Science.